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RESEARCH ARTICLE.........

Karyotypic report on three Sphingidae moths from Jammu (India)

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ABSTRACT...... For the first time, karyotypic studies are reported for three Sphingidae moths from Jammu (India). Images of mitotic and meiotic chromosomes of three Sphingidae moths *viz., Daphnis nerii, Agrius convolvuli, Acherontia styx* are depicted in the present communication.

KEY WORDS...... Sphingidae, Mitotic, Meiotic

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INTRODUCTION...

Although intense investigations on chromosome cytology of Lepidoptera have been carried out in different parts of the world, work in India is almost negligible (16 species by Srivastava and Gupta (1962), 30 by Rishi (1973), 9 by Gupta and Narang (1980), 16 by Mohanty and Nayak (1982), 7 sphingid moths by Mohanty and Nayak (1983a and b), 11 by Mohanty and Nayak (1984) and 31 by Kaur (1988). Karyotypic studies in Lepidoptera has been a difficult task due to small dot- like chromosomes of similar sizes. The chromosome cytology of Indian Lepidoptera is very much limited. The single family, Sphingidae is most diverse in tropical regions, but the large, fast-flying moths are familiar insects throughout the world. Sphingidae (Lepidoptera) species are called "hawk moths" or "sphinx". The hawk moths are medium to large-sized, heavy-bodied moths with characteristics of bullet shaped bodies and long, blade-like wings. Hawk moths are strong fliers, which can reach 40-50 km/hr. Hawkmoths (Lepidoptera: Sphingidae) comprise about 200 genera and 1300 species (Kitching and Cadiou, 2000). Hawkmoths have long been recognized as major pollinators of flowering plants (Baker, 1961 and Gregory, 1963).

The present communication deals with karyological study of somatic chromosomes from male and female and meiotic stages from male of three species of moths belonging to family Sphingidae.

RESEARCH METHODS....................................

Larvae of three species of Sphingid moths were collected from their respective host plants and were reared in cages. The fifth instar larvae and early pupae were found suitable for chromosomal investigation. Brain ganglia from male and female and testes from male were dissected out and fixed in Carnoy's fixative. Slides were prepared following the technique of Rishi *et al*. (1997) and stained in Giemsa stain. Slides were examined under binocular research microscope, good stages were photographed.

RESEARCH FINDINGS AND ANALYSIS...........

The results obtained from the present investigation as well as relevant discussion have been summarized

under the following heads :

Daphnis nerii :

The diploid number (2n) at somatic metaphase, both male and female consisted of 58 small, dot-like chromosomes (Fig. 1 and 2). In both size and morphology, the chromosomes were almost identical. The meiotic prophase in zygotene and pachytene showed elongated chromosomes, but their number was not countable at this stage. The pachytene bivalents showed lengthwise pairing of homologous chromosomes but exact position of chiasmata was not clear. The chromosomes appeared more and more condensed as they passed through diplotene to metaphase I. The diakinetic bivalents showed chiasma bearing shapes like cross, rod, ring, thereby suggesting positive occurrence of chiasmata. The metaphase I bivalents were at maximum state of condensation and were oval in shape and aligned at equator of the spindle with clearly visible spindle apparatus. Anaphasic movement was also seen (Fig.3-7).

Agrius convolvuli :

This species also showed the diploid number to be

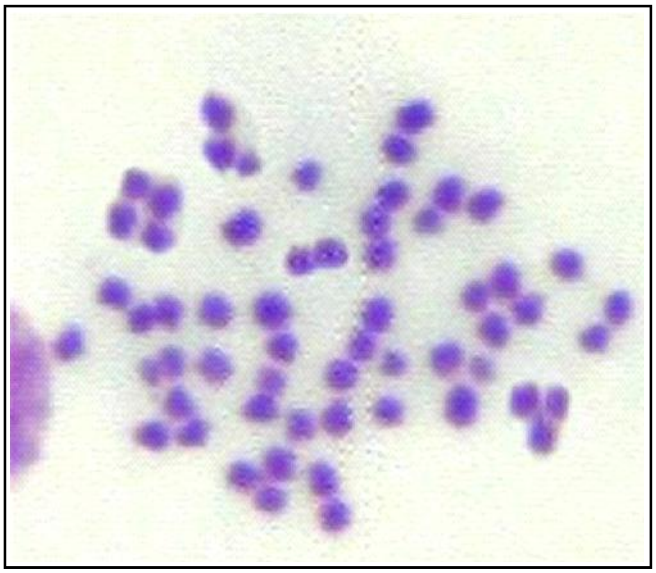

Fig. 1 : Somatic metaphase male *Daphnis nerii*

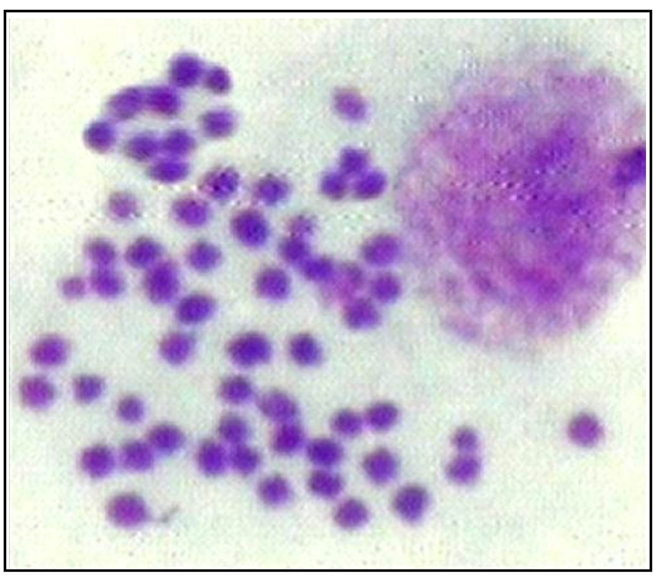

Fig. 2 : Somatic metaphase female *Daphnis nerii*

Fig. 3 : Zygotene

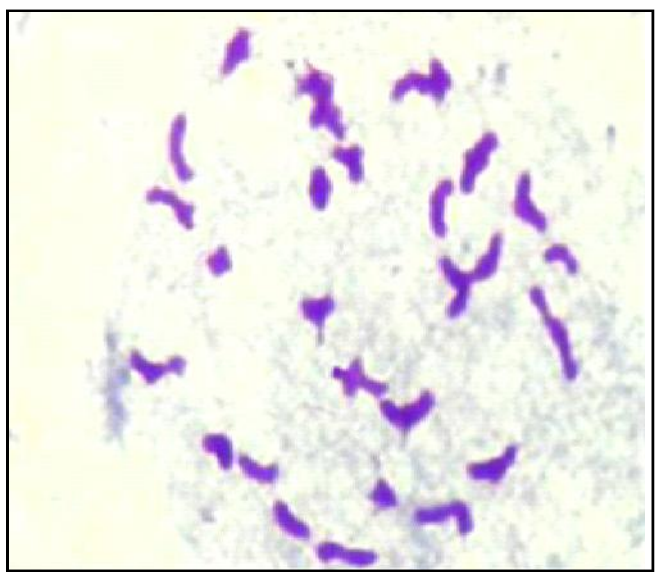

Fig. 4 : Diplotene

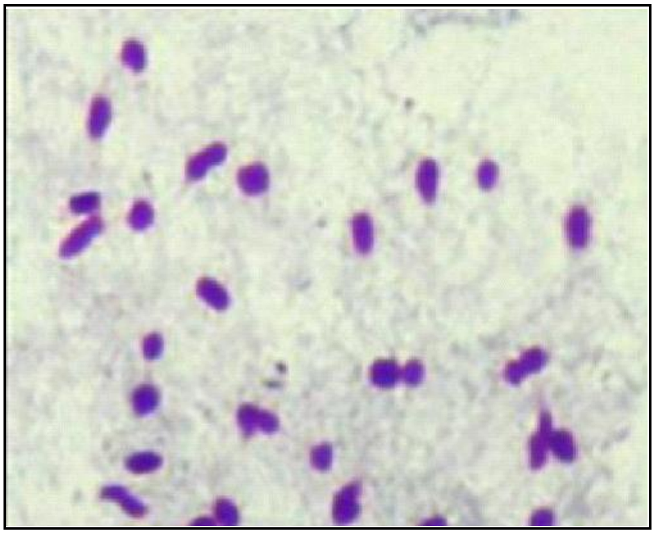

Fig. 5 : Diakinesis

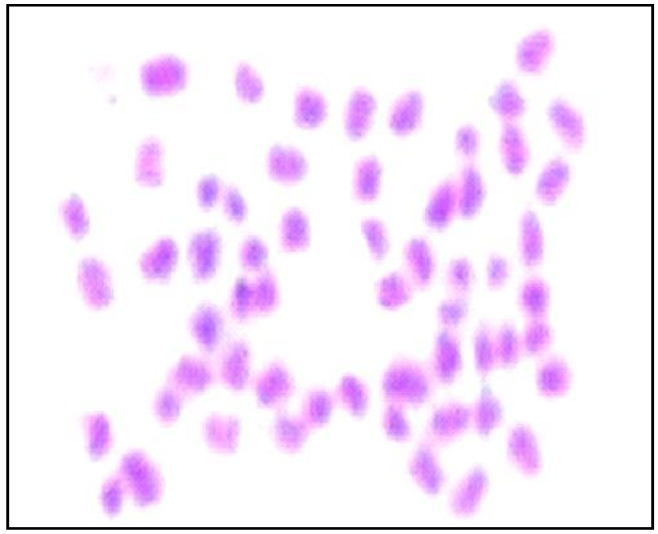

Fig. 8 : Somatic metaphase male *Agrius convolvuli*

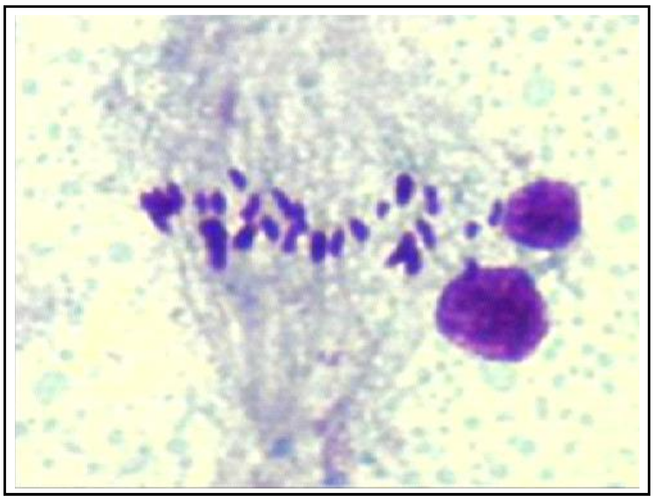

Fig. 6 : Metaphase I

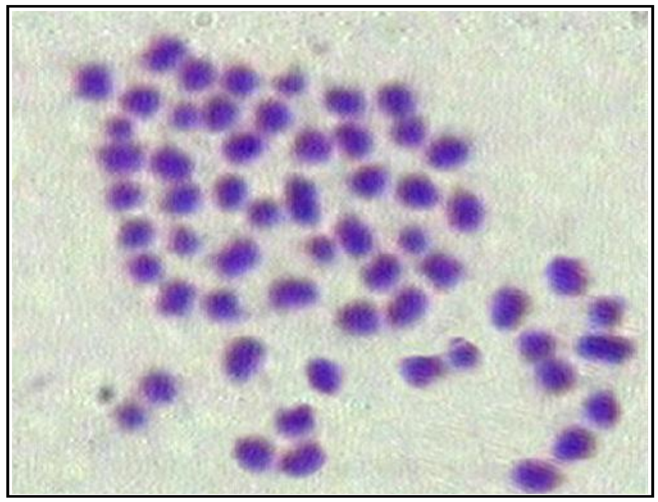

Fig. 9 : Somatic metaphase female *Agrius convolvuli*

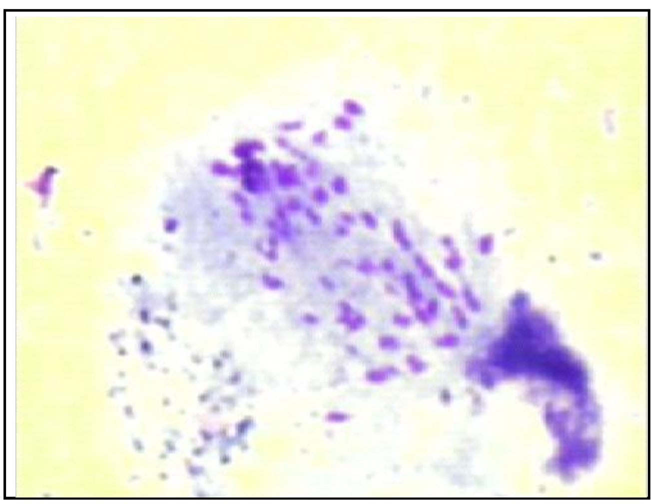

Fig. 7 : Anaphase I

Fig. 10 : Pachytene

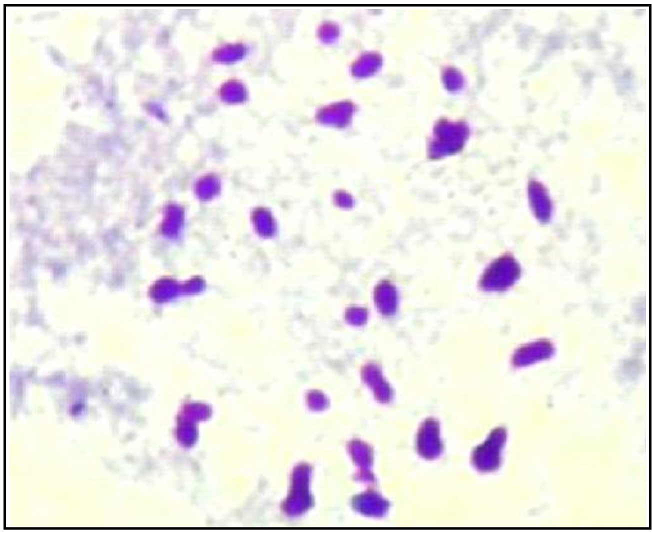

Fig. 11 : Metaphase I

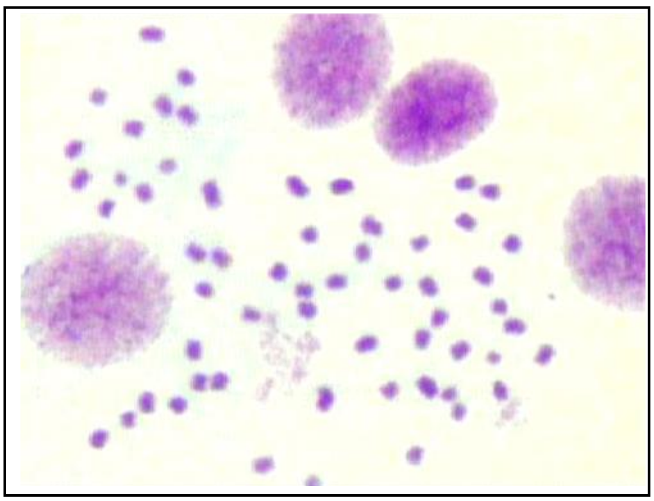

Fig. 12 : Somatic metaphase male *Acherontia styx*

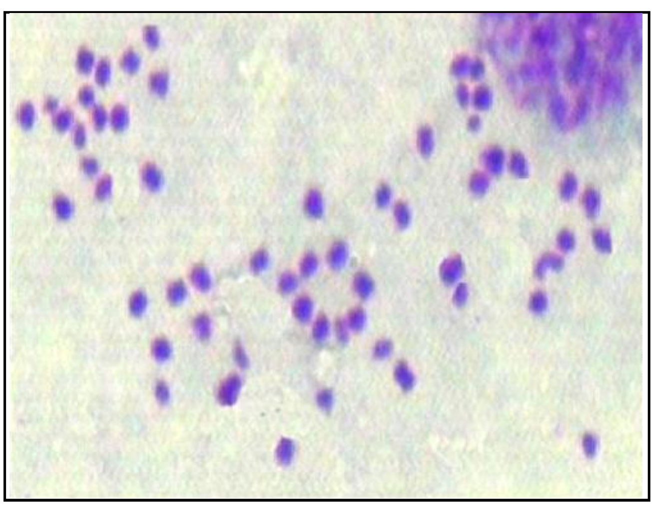

Fig. 13 : Somatic metaphase female *Acherontia styx*

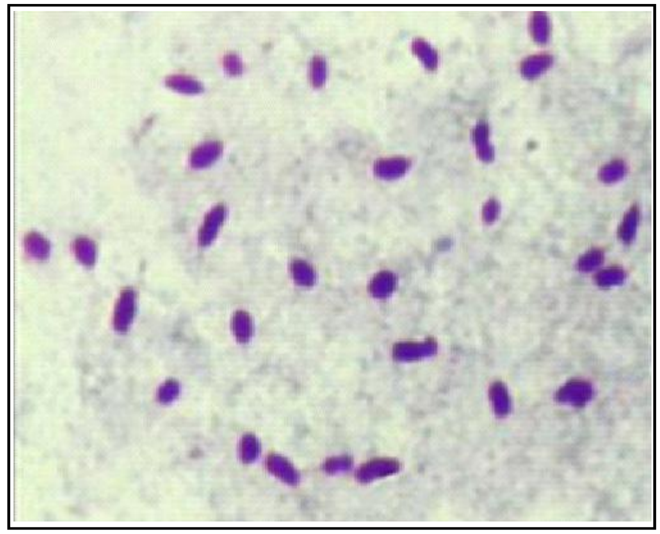

Fig. 14 : Metaphase I

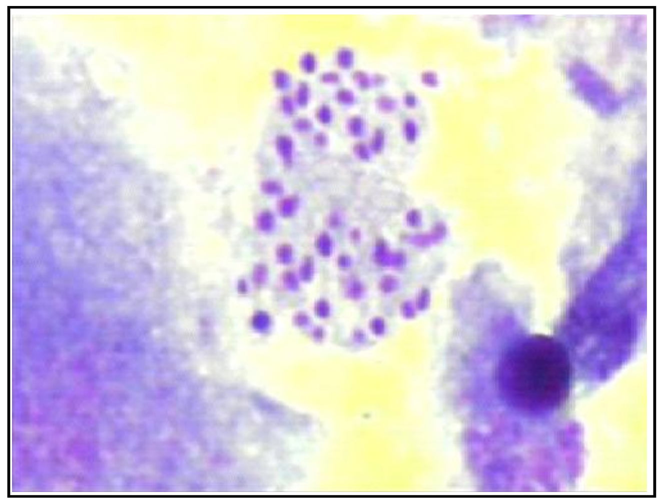

Fig. 15 : Anaphase I

58 from the somatic metaphases of both male and female larvae (Fig. 8 and 9). Good prophase stages were scored which confirmed the diploid number of the species (Fig. 10 and 11).

Acherontia styx :

2n=58, somatic metaphase showed 58 number of chromosomes (Fig. 12 and 13). Metaphase I showed 29 bivalents. Anaphase I was normal in good number of dividing cells (Fig. 14 and 15).

Lepidoptera include some in which all or almost all the species of *Papilio* have n=30, only a few having other numbers such as n=27 or 31 (Maeki and Remington, 1960a), almost all members of tribe Nymphalini have n=31 and all members of the Lemenitini have n=30 (Maeki

and Remington, 1961). There are many genera and tribes of Lepidoptera in which extreme variations in chromosome number occur. The three species of remarkable Giant Skippers (Megathymidae) that have haploid numbers of 21, 27 and 50 chromosomes (Maeki and Remington, 1960b).

Lepidopterans have been the textbook example of stable chromosome number in animals. White (1973) gives a histogram showing the chromosome numbers of about 740 species of butterflies. There is a distinct concentration of numbers around n=29, 30 and 31. The distribution is strongly skewed, with few numbers above n=31 and many numbers below n=29. White (1973) takes this distribution as evidence that mechanisms for reducing the chromosome numbers have been far more efficient than ones leading to increases in chromosome number above n=31. The distribution of chromosome numbers in moths is similar to that in butterflies (Robinson, 1971). Trichoptera, the sister order of lepidopterans, is characterized by n=30 (Suomalainen, 1969a and b). Deviation to this mechanism is shown by family Lycaenidae (bluewings) has a modal number n=24, different from that of all other lepidopterans.

The remarkable uniformity in morphology and behaviour of Lepidopteran chromosomes is well documented (Rishi, 1975 and Nayak, 1975). The present investigations agree with the earlier published data. The chromosomes are minute, homomorphic and isodiametric. In the family Sphingdae, 31 species have been cytologically worked out and the modal haploid number for this family has been established as n=29 (Robinson, 1971). Similar report has been given by Mohanty and Nayak, 1982. The highest chromosome number in the family (n=59 in *Langia zenzeroides nawai*) has been reported by Saitoh and Kumagai (1973). It differed from all others in having the haploid number almost double than that of the modal number (n=29) – A situation showing an indication of a phylogenetic pecularity of this subspecies. In the present analysis, the haploid chromosome number ascertained in three Sphingid moths is uniformly 29, in accordance with the modal haploid number for the family.

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